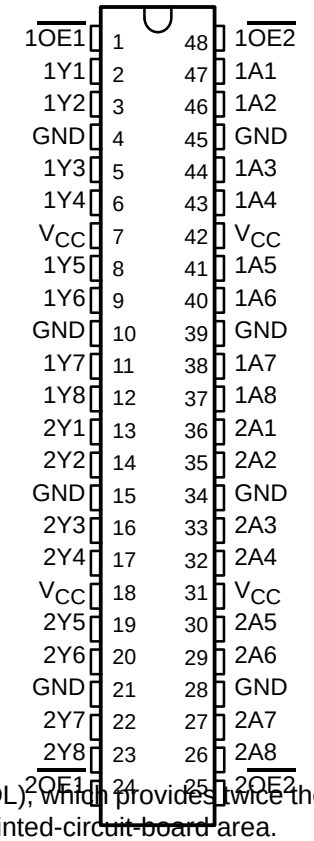
- **Members of the Texas Instruments Widebus™ Family**
- **Packaged in Shrink Small-Outline 300-mil Packages (DL) and 380-mil Fine-Pitch Ceramic Flat Packages (WD) Using 25-mil Center-to-Center Pin Spacings**
- **Flow-Through Architecture Optimizes Printed Circuit Board (PCB) Layout**
- **Distributed $V_{CC}$ and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm Process**
- **500-mA Typical Latch-Up Immunity at 125°C**

**AC16541 ... WD PACKAGE**
**AC16541 ... DL PACKAGE**

**(T0P VIEW)**




## description

These devices are noninverting 16-bit buffer composed of two 8-bit sections with separate output-enable signals. For either 8-bit buffer section, the two output-enable ($1\overline{OE1}$ and $1\overline{OE2}$ or $2\overline{OE1}$ and $2\overline{OE2}$) inputs must both be low for the corresponding Y outputs to be active. If either output-enable input is high, the outputs of that 8-bit buffer section are in the high-impedance state.

The 74AC16541 is packaged in TI's shrink small-outline package (DL), which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54AC16541 is characterized for operation over the full military temperature range of –55°C to 125°C. The 74AC16541 is characterized for operation from –40°C to 85°C.

**FUNCTION TABLE**
**(each 8-bit section)**

| INPUTS | | | OUTPUT |
|---|---|---|---|
| $\overline{OE}$ | $\overline{OE}$ | DIR | Y |
| L | L | L | L |
| L | L | H | H |
| H | X | X | Z |
| X | H | X | Z |

PRODUCT PREVIEW

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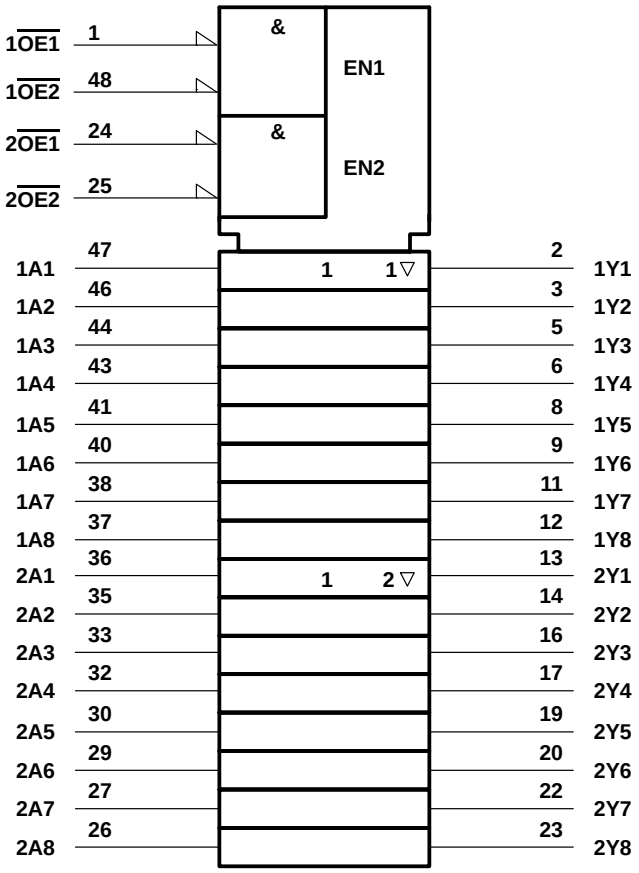
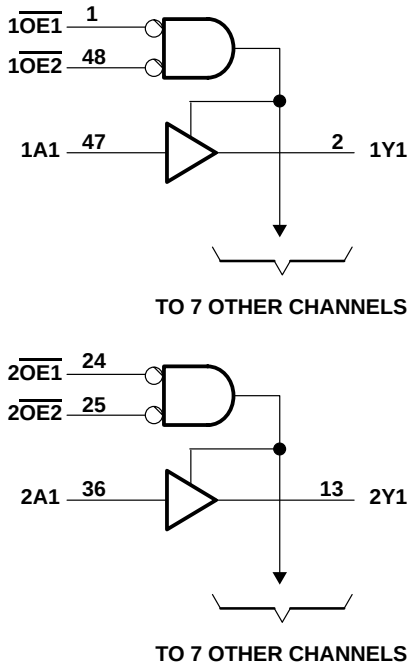
### logic symbol†




### logic diagram (positive logic)




† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers are for DW, JT, and NT packages

### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, $V_{CC}$ . . . . . –0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1) . . . . . –0.5 V to $V_{CC}$ + 0.5 V
Output voltage range, $V_O$ (see Note 1) . . . . . –0.5 V to $V_{CC}$ + 0.5 V
Input clamp current, $I_{IK}$ ($V_I$ < 0 or $V_I$ > $V_{CC}$) . . . . . ±20 mA
Output clamp current, $I_{OK}$ ($V_O$ < 0 or $V_O$ > $V_{CC}$) . . . . . ±50 mA
Continuous output current, $I_O$ ($V_O$ = 0 to $V_{CC}$) . . . . . ±50 mA
Continuous current through $V_{CC}$ or GND pins . . . . . ±400 mA
Maximum package power dissipation at $T_A$ or GND pins . . . . . 0.85 W
Storage temperature range . . . . . –65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

## recommended operating conditions (see Note 2)

| | | | 54AC16541 | | | 74AC16541 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | | 3 | 5 | 5.5 | 3 | 5 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 3 V | 2.1 | | | 2.1 | | | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | | | 3.15 | | | |
| | | $V_{CC}$ = 5.5 V | 3.85 | | | 3.85 | | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 3 V | | | 0.9 | | | 0.9 | V |
| | | $V_{CC}$ = 4.5 V | | | 1.35 | | | 1.35 | |
| | | $V_{CC}$ = 5.5 V | | | 1.65 | | | 1.65 | |
| $V_I$ | Input voltage | | 0 | | $V_{CC}$ | 0 | | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | | $V_{CC}$ | 0 | | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 3 V | | | –4 | | | –4 | mA |
| | | $V_{CC}$ = 4.5 V | | | –24 | | | –24 | |
| | | $V_{CC}$ = 5.5 V | | | –24 | | | –24 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 3 V | | | 12 | | | 12 | mA |
| | | $V_{CC}$ = 4.5 V | | | 24 | | | 24 | |
| | | $V_{CC}$ = 5.5 V | | | 24 | | | 24 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | | 0 | | 10 | 0 | | 10 | ns/V |
| $T_A$ | Operating free-air temperature | | –55 | | 125 | –40 | | 85 | °C |

NOTE 2: Unused or floating (input or I/O) must be held high or low

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $V_{CC}$ | $T_A$ = 25°C | | | 54AC16541 | | 74AC16541 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $V_{OH}$ | | $I_{OH}$ = –50 µA | 3 V | 2.9 | | | 2.9 | | 2.9 | | V |
| | | | 4.5 V | 4.4 | | | 4.4 | | 4.4 | | |
| | | | 5.5 V | 5.4 | | | 5.4 | | 5.4 | | |
| | | $I_{OH}$ = –4 mA | 3 V | 2.58 | | | 2.4 | | 2.48 | | |
| | | $I_{OH}$ = –24 mA | 4.5 V | 3.94 | | | 3.7 | | 3.8 | | |
| | | | 5.5 V | 4.94 | | | 4.7 | | 4.8 | | |
| | | $I_{OH}$ = –50 mA† | 5.5 V | | | | 3.85 | | | | |
| | | $I_{OH}$ = –75 mA† | 5.5 V | | | | | | 3.85 | | |
| $V_{OL}$ | | $I_{OL}$ = 50 µA | 3 V | | | 0.1 | | 0.1 | | 0.1 | V |
| | | | 4.5 V | | | 0.1 | | 0.1 | | 0.1 | |
| | | | 5.5 V | | | 0.1 | | 0.1 | | 0.1 | |
| | | $I_{OL}$ = 12 mA | 3 V | | | 0.36 | | 0.5 | | 0.44 | |
| | | $I_{OL}$ = 24 mA | 4.5 V | | | 0.36 | | 0.5 | | 0.44 | |
| | | | 5.5 V | | | 0.36 | | 0.5 | | 0.44 | |
| | | $I_{OL}$ = 50 mA† | 5.5 V | | | | | 1.65 | | | |
| | | $I_{OL}$ = 75 mA† | 5.5 V | | | | | | | 1.65 | |
| $I_I$ | Control inputs | $V_I = V_{CC}$ or GND | 5.5 V | | | ±0.1 | | ±1 | | ±1 | µA |
| $I_{OZ}$ | A or B ports‡ | $V_O = V_{CC}$ or GND | 5.5 V | | | ±0.5 | | ±10 | | ±5 | µA |
| $I_{CC}$ | | $V_I = V_{CC}$ or GND, $I_O$ = 0 | 5.5 V | | | 8 | | 160 | | 80 | µA |
| $C_i$ | Control inputs | $V_I = V_{CC}$ or GND | 5 V | | 4.5 | | | | | | pF |
| $C_{io}$ | A or B ports | $V_O = V_{CC}$ or GND | 5 V | | 16 | | | | | | pF |

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.
‡ For I/O ports, the parameter $I_{OZ}$ includes the input leakage current.

PRODUCT PREVIEW

**switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 3.3 V ± 0.3 V**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | | 54AC16541 | | 74AC16541 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | A | Y | | | | | | | | ns |
| $t_{PHL}$ | | | | | | | | | | |
| $t_{PZH}$ | $\overline{OE}$ | Y | | | | | | | | ns |
| $t_{PZL}$ | | | | | | | | | | |
| $t_{PHZ}$ | $\overline{OE}$ | Y | | | | | | | | ns |
| $t_{PLZ}$ | | | | | | | | | | |

**switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V ± 0.5 V**

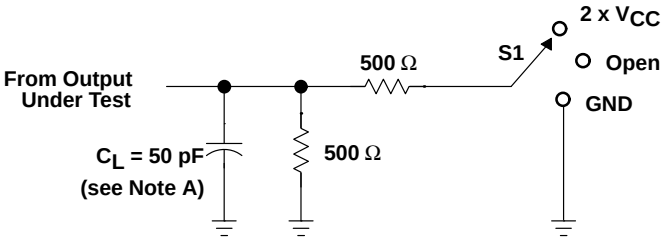
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | | 54AC16541 | | 74AC16541 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | A | Y | | | | | | | | ns |
| $t_{PHL}$ | | | | | | | | | | |
| $t_{PZH}$ | $\overline{OE}$ | Y | | | | | | | | ns |
| $t_{PZL}$ | | | | | | | | | | |
| $t_{PHZ}$ | $\overline{OE}$ | Y | | | | | | | | ns |
| $t_{PLZ}$ | | | | | | | | | | |

**operating characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C**

| PARAMETER | | | TEST CONDITIONS | | TYP | UNIT |
|---|---|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance per transceiver | Outputs enabled | $C_L$ = 50 pF | f = 1 MHz | | pF |
| | | Outputs disabled | | | | |

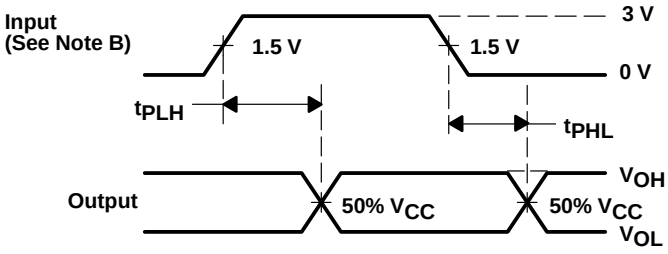
PRODUCT PREVIEW

## PARAMETER MEASUREMENT INFORMATION

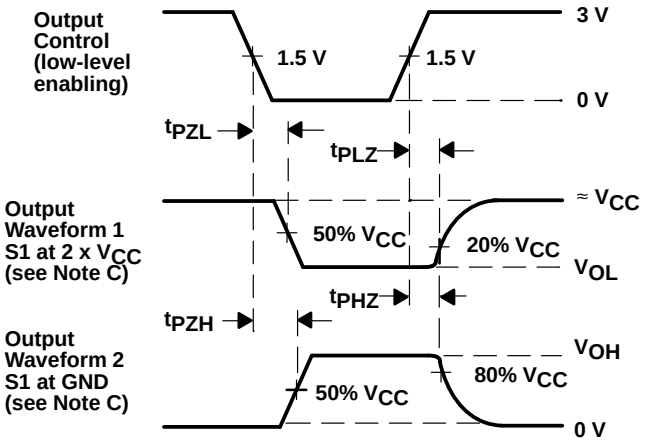



| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 2 x $V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

**LOAD CIRCUIT FOR OUTPUTS**




**VOLTAGE WAVEFORMS**
**PROPAGATION DELAY TIMES**




**VOLTAGE WAVEFORMS**
**ENABLE AND DISABLE TIMES**

NOTES: A. $C_L$ includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 3 ns, $t_f$ ≤ 3 ns. For testing pulse duration: $t_r = t_f$ = 1 to 3 ns. Pulse polarity can be either high-to-low-to-high or low-to-high-to-low.
C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
D. The outputs are measured one at a time with one transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

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